COGNITIVE STYLES IN CATEGORIZING BEHAVIOR

by

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Chapter I

INTRODUCTION

This dissertation has its roots in an approach to personality theory which expresses itself through studies of individual differences in adaptive modes of organizing and experiencing the stimulus world. The emphasis in these studies has been upon the person (37, 38, 44). The perceptual apparatus has been selected as the "window" into the person because of the unique opportunities it offers for observing in action the individual's style of adaptation to the world about him. Studies of individual differences in respect to certain perceptual properties have suggested several meaningful dimensions along which such differences can be arranged, e.g., leveling-sharpening and tolerance versus intolerance for instability (32, 40, 41, 45, 22). The extremes of these dimensions have been said to reflect contrasting perceptual attitudes or "Anschauungen." The present study is an attempt to establish another such meaningful dimension. The phenomena we are concerned with can best be subsumed under the general heading of individual differences in equivalence range.

In the past few years many experimental studies have demonstrated that "central" personality factors have shaping or organizing effects upon those aspects of the organism's functioning generally classified as "perceptual." These investigations have taken various forms. They

include demonstrations of the effects of experimentally-imposed needs upon perceptual organization (e.g., 12, 59), explorations of various adaptive and "defensive" mechanisms (e.g., 13), and studies of the role of "assumptions" from past experience upon the momentary organization of the perceptual field (e.g., 4, 5, 36). The emphasis of the present study has been placed upon certain long-term, preferred modes of perceptual organization which are considered to be representative of some of the most central and enduring aspects of the individual's orientation towards his world. The research does not attempt to shed direct light upon the matrix of central factors which are assumed to underlie differences in equivalence range. It attempts, rather, only to explore one possible dimension of individual differences in the organization of experience--relative broadness or narrowness of equivalence range--as this may appear in categorizing behavior proper, in constancy situations, and in a task involving judgments of brightness. It should be emphasized that we are not exploring these tasks in order to gain knowledge about judgments of constancy or brightness per se. The tasks provide for representative situations which, we hope to demonstrate, call forth characteristic adaptive responses from individual subjects.

In addition to the experimental matrix commented upon above, this research stems from an interest in the gross and widely different modes of reality-testing which seem in clinical observation to be characteristic of different persons. Also, some aspects of the thinking behind the present formulation of the problem are based on

personal introspections of the writer, who in a sense served as the "first subject."

The Nature of the Problem

It is an everyday clinical observation that persons vary widely in the "span" or "realm" (cf. 61) of objects, qualities, and so on, which they are willing to subsume under one conceptual rubric as being "the same" in the sense of being "not different." For example, in clinical sorting tests some persons seem perfectly comfortable in designating a wide variety of objects as "tools" or a wide range of colors as "red." Others become noticeably uncomfortable when confronted with such groupings and seem impelled to subdivide the realms into more categories, with fewer objects or a narrower range of qualities included in each. Thus, some persons seem constantly and spontaneously to be "honeycombing" stimuli into small compartments, as if this were for them an especially important mode of coming to terms with the world about them. Others seem most comfortable with more inclusive categorizations. Clinical observation thus suggests that a preferential factor is at work in such behavior--a factor which is not tied solely either to intelligence or to capacity as these are usually understood.

One might immediately wonder whether the number of groups a person arrives at in such tasks would depend upon the number of rubrics he can command to represent subtle distinctions. Clinical experience suggests, however, that conceptual level (degree of abstractness,

as usually defined) is not necessarily related to the person's spontaneous sorting of objects or qualities into small or large groups. A person who gives every indication of having an extensive manifold of terms for shades of red, each applying to but a few of the referents associated for him under a general heading of "red," may prefer to group widely different shades into one realm and may resist a further subdivision with some firmness, as if he felt this to be picayune or unnecessarily meticulous. In fact, the studies of Halstead (27, 28), Goldstein and Scheerer (25), and others on persons with brain damage suggest that often the person with the most impaired potential for abstracting relationships is the one who feels compelled to divide and subdivide, even when he can say only "These (off-shades of red) are not red!" or "These are different reds." On the other hand, it is not difficult to find two non-brain-injured persons of comparable test intelligence, social level, and accomplishments, one of whom will sort with extreme attention to subtle differences, while the other includes a wide variety of objects or stimulus qualities under one heading.

It should be stated here that the present study is not concerned solely with the kinds of equivalence-range phenomena which appear in such highly conceptual activities as object sorting tests. It is assumed that the person's response to a sorting task is but one expression of certain centrally-determined modes of organization of stimuli, and that these modes will be demonstrable also in tasks which involve much less of conscious conceptualizing.

Klüver (47) has suggested that variations of the method of equivalent stimuli may be useful in the study of personality. He also has pointed out that the classical constancy situations involve one kind of equivalence judgment. The ways in which equivalence judgments in sorting tasks and in constancy situations are related, however, are not easily discernible. Most constancy studies have been aimed at general factors operative in all individuals. Only a very few studies (e.g., 66, 67, 74) have hinted at the possibility that personal styles of experiencing may in part account for the wide individual differences in constancy judgments. Thouless' data, for example, indicate large variations between persons, extending in apparent size judgments from the choice of comparison figures approximating the real object to figures producing almost the same retinal image as the standard stimulus. He suggested tentatively that there may be a relationship between such a dimension as introversion-extroversion and the degree to which a subject's judgment reflects "regression toward the real object." But he did not explore his own suggestion further. Thus, although wide individual differences have been observed in constancy judgments, the meaning of these differences for the persons involved remains obscure.

In view of the somewhat different approach made to equivalence-range phenomena in the present study, a comprehensive review of the voluminous literatures on concept formation tasks and constancy judgments would seem to offer little to the description of the problem at hand. It should be noted, however, that other experimenters,

e.g., Sheehan (63), have found low correlations between various kinds of constancy judgments. Also, in her study, variations in the stimulus materials seemed to produce marked changes in the subjects' responses. Sheehan emphasized her conclusion that there is no central organizing principle which controls any one person's functioning in all constancy situations. Agreed. But there are other ways to think about the organization of a subject's behavior in constancy situations.

In Sheehan's study, as in many others in the area of constancy phenomena, subjects were given relatively brief instruction and were allowed relatively little time in which to make their judgments. A section has been included below on ways in which subjects in the present experiment were treated and instructed in order to facilitate their making the best or most preferential judgment possible.

As an extension of the thinking about equivalence-range phenomena in categorizing and constancy tasks, the writer included one additional kind of judgment among the "core tasks" of the experiment: a judgment of the point at which two patches of light are exactly the same in brightness. It was felt that if consistent individual differences in equivalence range were predictable in this relatively basic kind of sensory judgment, additional credence would be given to the assumption that these differences are representative of centrally-determined modes of perceptual organization. The writer was stimulated to include this task in the battery of tests by certain

suggestions of Klein (37) concerning the possible meaningfulness of individual variations in differential thresholds.

The sketch of the problem appearing above says nothing about the significance of the indicated possibilities. Suppose a relationship can be demonstrated between the preferential size of conceptual realms characteristic for a person, his position on a scale of constancy judgments, and his position on a scale of error in judgments of equal brightness. Why is this important?

1) To say that perception is a continuous, active, adaptive process and thus partakes of the manifold needs and desires of the organism is but to state the problem for further research. The task of the experimenter whose preferred "window" into the person is a perceptual one would seem to be that of determining how, in what ways, and under what conditions these statements are true. Each of the various modalities through which the organism experiences and responds to the world seems at first glance to have a "language" of its own. The relationships between the effects of certain assumed long-term, preferred modes of perceptual organization are by no means obvious. If we choose to express our belief in the integration of any person's functioning in terms of central factors which play a role in all his behavior, we are called upon, first of all, to demonstrate the existence of constant patterns of response in his organization of experience in various adaptive tasks. Sometimes these investigations involve tasks which seem superficially to be unrelated in the functions they

demand of the person. In such cases, the demonstration of substrata of unique patternings of perceptual organization can contribute to our understanding both of the nature of the task and of the person's response to it. In the present research we have included three general kinds of apparently discrete tasks. The tests chosen might be said to represent widely different degrees of complexity of function, at least as this term implies differences in the degree of conscious deliberative behavior.

2) However much we may wish to believe that the terms "cognition" and "perception" represent artificial abstractions from a common adaptive process, abstractions enforced only by the tradition of dividing the person into areas of study, our assumption has little meaning unless we can demonstrate common substrata for behaviors generally thought to be of different kinds. The present study may begin to close the gap between areas of psychology long thought to be relatively discrete.

3) The experimental area under consideration, being comparatively novel, contains many uncharted gaps. A demonstration of the relationships postulated here would give the experimenter a grasp on one aspect of personal styles in perception. This demonstration would make possible a series of further explorations of differences in subjects with varying equivalence ranges: their behavior in tasks involving other modalities than those investigated here; their performance in problem-solving situations; and the like. In fact, although such factors

cannot yet be explored, certain speculations about different ways of handling affect formed an extremely important part of the conceptual matrix from which the present hypotheses arose.

Sampling the Subject

The writer believes that the results of this experiment can be understood, and the experiment itself made reproduceable, only if particular care is taken to describe the emotional atmosphere provided for the subjects, the ways in which the writer attempted to relate himself to the subjects, and the nature of the judgments they were encouraged to make. This precaution seems especially pertinent since, on superficial examination, the results of the study may seem to be at variance with those of some previous studies, particularly the results dealing with constancy phenomena. Also, in the course of his reading in the area of constancy studies, the writer repeatedly noticed that in some of these experiments the subjects were provided with minimal instructions and were given relatively little time to make their judgments. It was the writer's experience during pilot studies that he obtained one kind of response from a subject if he gave brief instructions, hurried the subject through the judgments, or suppressed questions about the experiment, but obtained another kind of response if he acted otherwise. It appeared that for a person to make a truly representative preferential arrangement of objects in the sorting test, he had to be encouraged to feel free to express himself in the situation. Some subjects

seemed to approach the task with the anticipation that there was an "answer" which they should try to discern. With these persons particular care was taken to emphasize that "there is no answer to this," and that "everyone does it his own way." In the constancy situations it was discovered that even very bright subjects may have considerable difficulty in "getting the feel" of the experience of apparent size or shape. In no case was a subject allowed to make experimental judgments until the writer had demonstrated the phenomenon and until the subject could report convincingly that in an exaggerated example he could make a judgment of apparent qualities. Thus, the time spent with individual subjects preliminary to the judgments varied.

As suggested above, there was a definite attempt to make each subject as comfortable as possible in the testing situation. This was facilitated by the fact that many of the subjects were known to the writer prior to the experiment. With other subjects an initial period was spent in which the writer and the subject became better acquainted; in which the subject was encouraged to feel free to make whatever judgments seemed best to him; and in which it was emphasized that on none of the tests were there any pre-determined answers.

The successes of these efforts may be reflected in some observations of the subjects' behavior during and after the experimental session. All subjects seemed to enjoy the testing, with important differences in quality which we have tried to capture in the Results

section of this dissertation. Many of them commented upon this during the experiment. Without being asked to do so, a number of the subjects took it upon themselves to recruit their wives, fellow employees, or others to take part. Several persons who had heard indirectly of the experiment asked the writer if they, too, could act as subjects.

During the actual testing, subjects were repeatedly encouraged to take their time with the judgments. In the size constancy (object) situation, for example they were encouraged to check and re-check their decisions. In the brightness situations, they were encouraged after the first judgment to close their eyes and to check and re-check until they were as sure as they could be that the two patches of light were equal in brightness. Under these instructions some persons who might have made impulsive or careless decisions, or have guessed had they felt hurried, were observed to correct their judgments carefully when it was pointed out to them that there was no premium on speed. It was the consistent impression of the writer that to allow all subjects identical brief periods in which to make judgments would have been to obtain from one of them a fairly accurate picture of how he preferred to organize the stimuli; from another, an incomplete stage of approximation in making the judgment; from still another, a guess.

The above samples of the approach to the subjects represent the belief that the investigation of preferential modes of organizing experience is a unique kind of experimental endeavor calling for

special consideration of the experimenter's relationship with the subject. It was a repeated observation in pilot and pre-pilot studies, for example, that a person who is treated as "someone to make a judgment" does not achieve the kind of ease, comfort, and freedom to express himself which allows his uniqueness to display itself to best advantage. It was the writer's impression that when subjects were treated in this way the consistency of individual differences across tests tended to decrease. Although the specific relationships hypothesized in the next section might have appeared without such special considerations, it is felt that their significance was enhanced by allowing each of the test situations to be an adaptive task and by eliciting from the subject the kind of "sample" of his behavior most likely to reflect his unique attributes.

There is some evidence in the literature on ego-involvement which gives support to this impression. Allport points to several studies, including one by Klein and Schoenfeld (46), as demonstrating the principle that (3, p. 461): "When there is ego-involvement there are general traits; when there is no ego-involvement there are no general traits." Although ego-involvement was not achieved in the usual ways in the present experiment, the difference in the results under varied approaches to the subjects makes it appear that something very similar to what Klein and Schoenfeld reported occurred with the subjects of our pilot studies.

Hypotheses

The general hypothesis is that individuals are characterized by differences in equivalence range which can be demonstrated in a variety of adaptive tasks.

The more specific hypotheses can be stated as follows. The smaller a subject's conceptual realms in the object sorting test, i.e., the smaller his categories, the more he will be able: 1) in a constancy situation, to "analyze out" the retinal impression from his knowledge or awareness of the real object; 2) in a brightness judgment, to make an objectively accurate estimate of equivalence. That is, in constancy situations calling for judgments of apparent size and shape, we expect subjects with smaller conceptual realms in the sorting test to make sensory judgments more accurately than subjects given to broader categorizations. On the other hand, when object judgments are requested, we expect the same persons to be better able to "analyze out" the true object size in the face of interfering conditions, such as different distances to the standard and comparison stimuli. In a task requiring subjects to equate the brightness of two patches of light, we again expect these subjects to make more accurate judgments. And, if the subjects are divided into two sections on the basis of number of groups produced in the object sorting test, we expect the differences between the mean errors for these two sections on brightness discriminations to become progressively greater as the difficulty of the task is increased. This

is a way of saying that for the "honeycomber" the range of brightness that can be accepted as identical to the standard stimulus will be smaller than for the subject given to broader conceptual realms.

The hypotheses stem from the consideration that persons who habitually categorize the world about them into small compartments will be able to "focus" more intensely upon whatever aspect of the sensory-object relationship is called for than will those persons who more easily concede homogeneity and likeness to the diversity of stimuli which surrounds them. It is not our assumption that either extreme of approach is more adaptive than the other, since this obviously depends upon all the conditions operating at any moment.

In one sense, the hypotheses could all be stated in terms of categorizing functions: The person whose bent is towards dividing and subdividing should be better able to "categorize" conflicting aspects of the constancy and brightness experiences. That is, in the constancy situations he should be better able to segregate the real from the apparent, or vice-versa. In the brightness situation he should be better able to approximate the objectively correct.

Since the hypotheses predict "high" judgments for the "honeycomber" on some measures, and "low" judgments on others, it may be well to give an example of our expectations. In an ideal case, the subject with the largest number of groups (smallest number of objects per group)

would be expected to perform on the other tests as follows: 1) size constancy (object) judgments--make a perfect object judgment, in spite of the different distances to the standard and comparison figures (average error = 0); 2) size constancy (sensory) judgments--choose the figure exactly equal in retinal image to the standard stimulus; 3) shape constancy (sensory) judgments--choose the figure exactly equivalent in retinal image to the standard figure; 4) brightness judgments--make perfect judgments, exactly equating the brightness of the two patches of light under all three levels of difficulty (average error = 0).

CHAPTER II

EXPERIMENTAL PROCEDURES

Subjects

The subjects for this study were 30 women and 20 men, ranging in age from 18 to 30, with a mean age of 23.02. Of this group 19 were university students, 27 were employees of the Menninger Foundation (secretaries, adjunctive therapy workers and students, office workers), three were housewives, and one was a kindergarten teacher. A rough check on intelligence level is supplied by the fact that 44 of the subjects attended or were graduated from a college or university. Most of those who had not attended college were employed at tasks usually requiring a college degree. All subjects were judged to be of at least normal intelligence, with most of them in the bright normal to superior range.

Tests

Subjects were seen individually for the following tests: 1) object sorting test; 2) size constancy (object) judgments; 3) size constancy (sensory) judgments; 4) shape constancy (sensory) judgments; 5) brightness judgments. Four tasks not reported upon here were also administered during the experimental session: 1) judgments of triangularity and circularity (discussed below); 2) the F-Scale, from studies of the authoritarian personality (1); 3) a series of tachistoscopically-presented figures which the subjects

were asked to reproduce; and 4) a memory task involving the two stories from the Babcock Test (6). The last three of these tasks were included only in the hope that they would produce further hypotheses about the meaning of the predicted differences in equivalence ranges. Mention is made of these in the Discussion section of the dissertation, which also contains a list of studies suggested by the results on the five "core" tests.

The judgments of triangularity and circularity were originally seen as a possible addition to the criterion measure for categorizing behavior, the object sorting test. Twenty squares of white cardboard, six inches on a side, bearing a graded series of figures ranging from circular to triangular, were presented to the subjects. These figures were modified from a series used by Zaslow (77) in studies of conceptual thinking in schizophrenia. In pilot studies they showed promise as an additional "criterion" measure. In the experiment itself, however, they showed little more than chance relationship to the results of the object sorting test. Since the latter was believed to produce a much better sample of categorizing preferences, the figures were dropped as a criterion measure. Qualitative observations suggest (as do Zaslow's results) that these figures, having less meaningfulness and being surrounded for the subjects by relatively stereotyped notions of triangularity and circularity, should not be expected to produce the range of differences drawn out by such a task as the object sorting test.

All constancy judgments in the experiment were made in a section of the laboratory enclosed by walls of black cloth. The object sorting test was done on the table used for the constancy judgments (Figure 1). Lighting for these situations consisted of ordinary room illumination from two overhead fixtures.

Object Sorting Test: Materials for this test were 73 objects, most of them familiar to the subjects from everyday experience. The items were selected with an eye to variations in materials, colors, shapes, sizes, and combinations of these. They were presented to the subjects in random order, an example of which appears in Figure 1. The objects were:

1) red cardboard circle; 2) red and white oil cloth, roughly rectangular; 3) half bar of soap; 4) yellow pencil; 5) small glass jar, 6) white jar lid (fits small glass jar); 7) flash-light bulb; 8) small light bulb; 9) and 10) small blue candle; 11) and 12) blue plastic candle holder; 13) dime; 14) penny; 15) metal fork; 16) metal knife; 17) metal spoon; 18) small red plastic spoon; 19) small blue plastic spoon; 20) small red plastic knife; 21) white plastic button; 22) cigarette; 23) cigar wrapped in cellophane; 24) jar rubber; 25) red paper rectangle; 26) white leatherette doll shoe; 27) padlock and key--green design; 28) block of wood with nail; 29) block of wood painted yellow; 30) block of plywood with red paper pasted on one side; 31) medicine dropper; 32) small printed picture, colored--western scene; 33) ping-pong ball; 34) piece of white chalk; 35) black and yellow fishing fly; 36) green wooden spool with roll of fine wire; 37) hairpin; 38) pipe bowl; 39) pipe stem (fits pipe bowl); 40) bottle of mercurochrome; 41) nail; 42) rubber stopper with metal ring; 43) picture postcard, black and white--wood scene; 44) piece of large white candle; 45) and 46) small corks; 47) orange sucker with paper handle; wrapped in cellophane; 48) orange vitamin pill; 49) metal staple with paper on head; 50) sugar cube; 51) olive drab whistle with white star design; 52) small pebble; 53) mothball; 54) putty knife with red wooden handle; 55) blue plastic comb; 56) metal thimble; 57) metal pulley with white porcelain wheel; 58) white rectangular card; 59) two German stamps, one red and

one green, attached to each other; 60) whiskbroom; 61) toy hammer with red wooden handle; 62) toy metal saw; 63) bicycle bell; 64) piece of chamois skin; 65) rubber nipple; 66) green plastic earring with metal clip; 67) bow tie on cardboard holder; 68) suede brush, metal and wood, with paper price tag; 69) piece of fine sandpaper; 70) plastic dark glasses with metal clip; 71) red lipstick container; 72) screwdriver; 73) piece of red crayon.

Subjects were first asked to examine the objects and to inquire about any they were not familiar with. They were instructed as follows:

> First of all, I want you to know that there is no answer to this test. Everyone does it in his own way. I want you to do it in the way that seems most natural, most logical, and most comfortable to you. The instructions are simply to put together into groups the objects which seem to you to belong together. You may have as many or as few objects in a group as you like, so long as the objects in each group belong together for one particular reason. If, after you have thought about all the objects, a few do not seem to belong with <u>any</u> of the others, you may put those objects into groups by themselves. Please sort all the objects.

During the sorting, the experimenter made notes on qualitative features of the subject's performance, such as comments, re-groupings, questions, and the like. Following the grouping of all objects, he asked for and recorded the subject's reason for including the objects in each group. Thus, moving from group to group, he asked: "Why do these objects belong together?" and recorded verbatim the subject's response.

The score used was the number of groups each subject made. In those rare instances in which a subject obviously had one large group with very definite subdivisions (e.g., a hierarchical arrangement), each definite subgroup was considered a separate group.

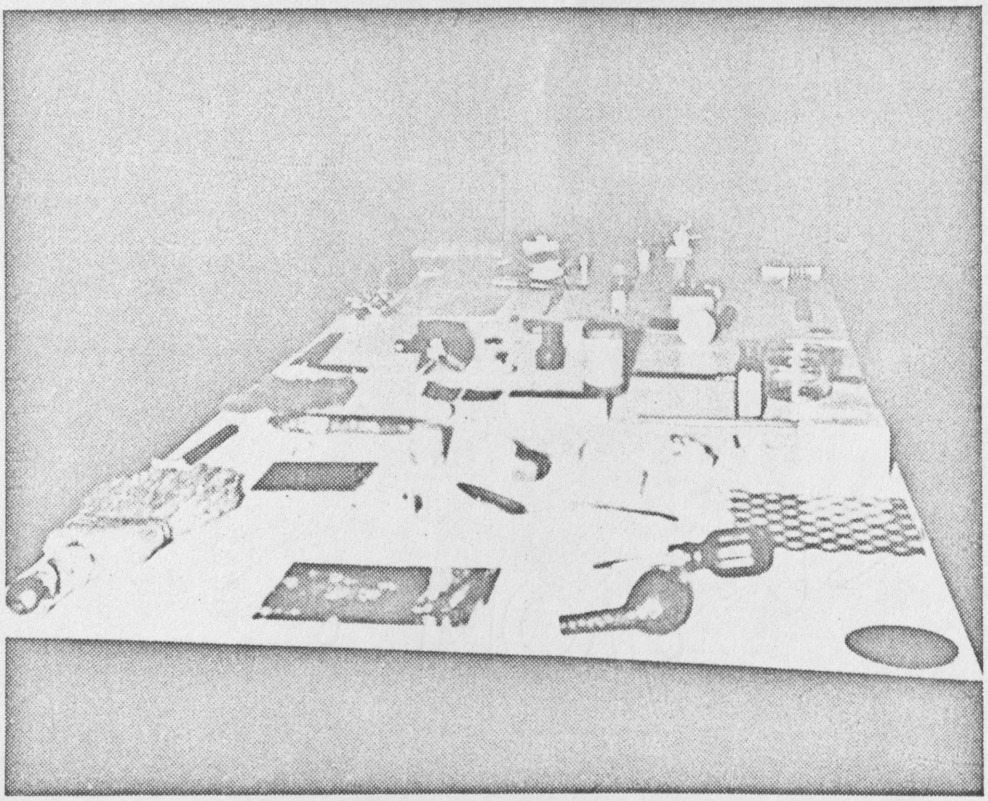

FIGURE 1. OBJECT SORTING TEST MATERIALS.

Size Constancy (Object) Judgments: Apparatus for this test was similar to one described by Thurstone (69). The standard was a black cardboard triangle, nine inches on each side, mounted on a 15 by 16 inch white cardboard field. This triangle was placed six feet from the subject's eyes, as shown in Figure 2. The comparison stimulus was a black cardboard triangle whose size could be varied by pulling it through a horizontal slit in a sheet of white cardboard 28 by 34 inches. It was supported by a fine white cord running over a pulley and was counterbalanced by a weight, as shown in Figure 3. The maximum size of this triangle was 18 inches on each side. This comparison stimulus was placed 12 feet from the subject's eyes.

The test consisted of one ascending and one descending trial. The instructions were:

> This is the only judgment of its kind in this experiment. It is a judgment of actual size. This figure will remain the same (E. points to the standard). You will see that here (E. points to the comparison stimulus) I have an apparatus with which I can vary the size of this second figure (demonstrates). First, I will slowly increase the size of this figure until you tell me the two figures are exactly the same size. If you wish to stop and check at any point, just tell me. And if you overshoot the first time, feel free to direct me so that the two triangles are exactly the same actual size.

After the subject had made his first judgment, he was asked to look away for a few seconds and then check his judgment, "to make sure that it is the best judgment you can make." Subjects were encouraged to take their time and to check as many times as they wished. Following the ascending trial, these instructions were given:

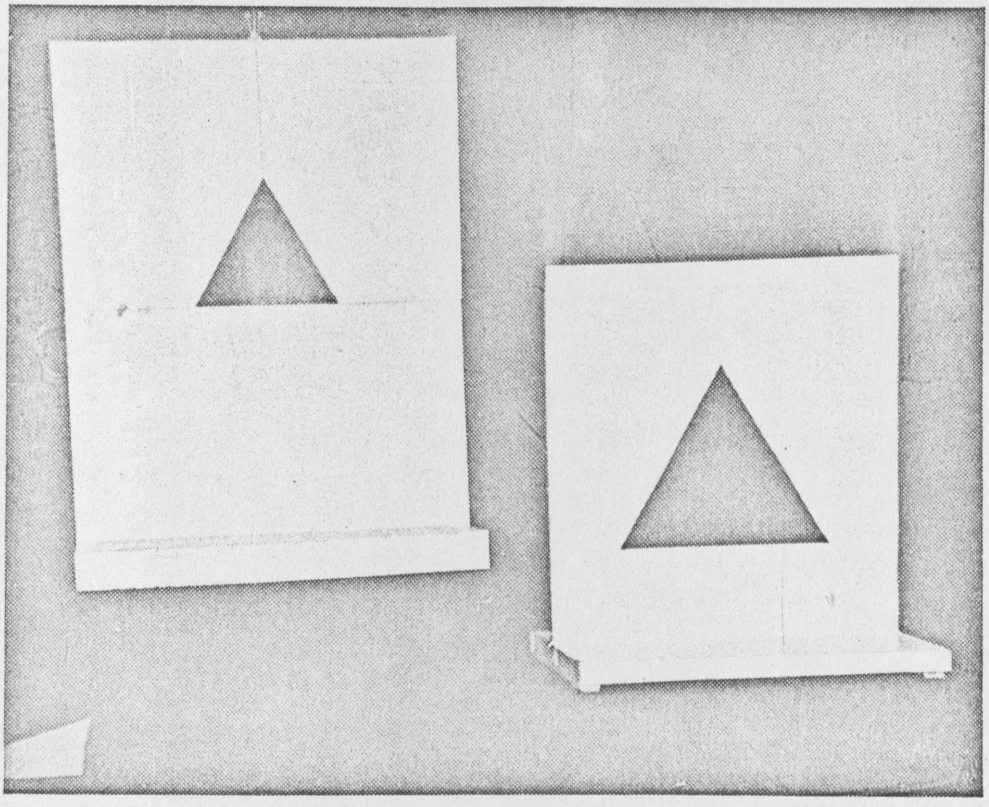

FIGURE 2. SIZE CONSTANCY (OBJECT) APPARATUS.

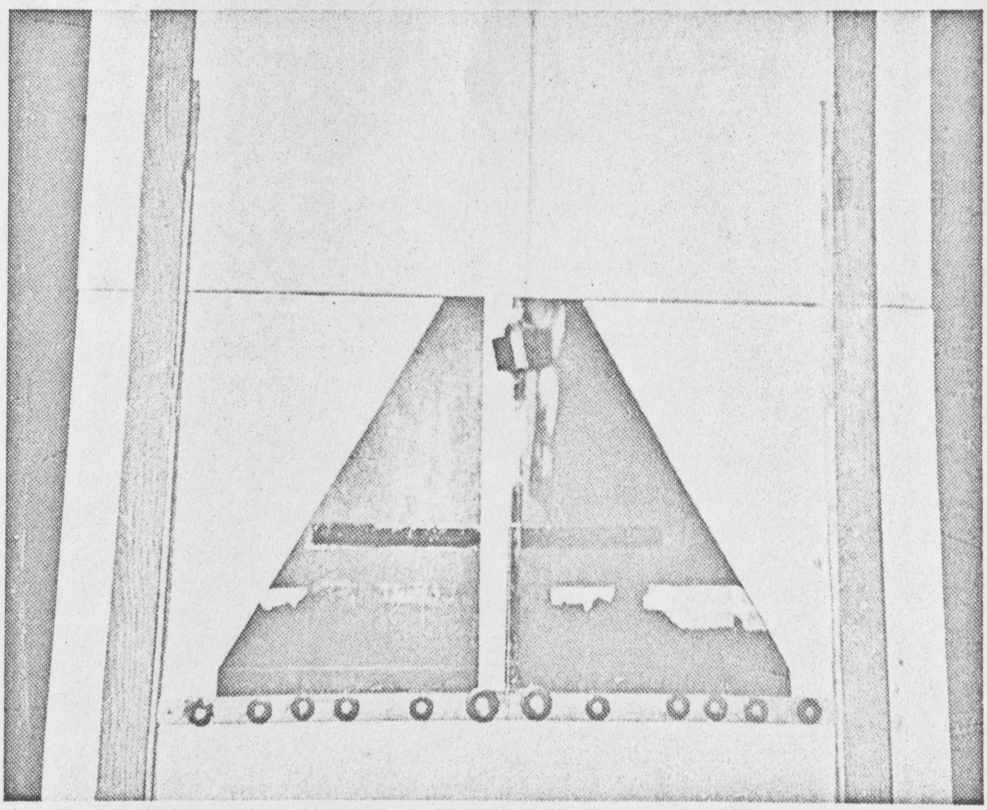

FIGURE 3. REVERSE SIDE OF SIZE CONSTANCY (OBJECT) APPARATUS.

Now I will begin with this figure at its largest size and slowly decrease its size until you tell me again that the two figures are exactly the same actual size.

As in the ascending trial, subjects were asked to look away and to check their judgments.

The score used was the average error for the two trials. This error was measured in centimeters by means of a scale attached to the back of the comparison stimulus (Figure 3). The height of the standard triangle was approximately 20 cm.

Size Constancy (Sensory) Judgments: This situation was modeled after one of Thouless' techniques (67). The standard figure was a circle of white cardboard, 39.7 cm. in diameter. It was placed at right angles to the subject's line of vision (monocular) at a distance of 230 cm. The subject viewed all figures through a reduction screen having a two by 3/4 inch aperture 48.5 cm. above the table (Figure 4). A series of 23 circles varying in diameter from 29.7 cm. to 39.7 cm. was presented to the subject at right angles to his line of vision at a distance of 172 cm. and to the left of the standard. The diameter of the comparison circles varied by $1\frac{1}{4}$ per cent of the diameter of the standard (Table I). The sizes of retinal images for the apparent size and shape situations were estimated by means of methods suggested by Graham (26). The comparison figure making an equivalent retinal image at 172 cm. to that of the standard at 230 cm. would be approximately 29.7 cm. in diameter. The test proper consisted

TABLE I

COMPARISON FIGURES FOR SIZE CONSTANCY (SENSORY) JUDGMENTS

Figure Number	Diameter in Cm.
1	39.7
2	39.2
3	38.7
4	38.2
5	37.7
6	37.2
7	36.7
8	36.2
9	35.7
10	35.2
11	34.7
12	34.2
13	33.7
14	33.2
15	32.7
16	32.3
17	31.8
18	31.3
19	30.8
20	30.3
21	29.8
22	29.3
23	28.8

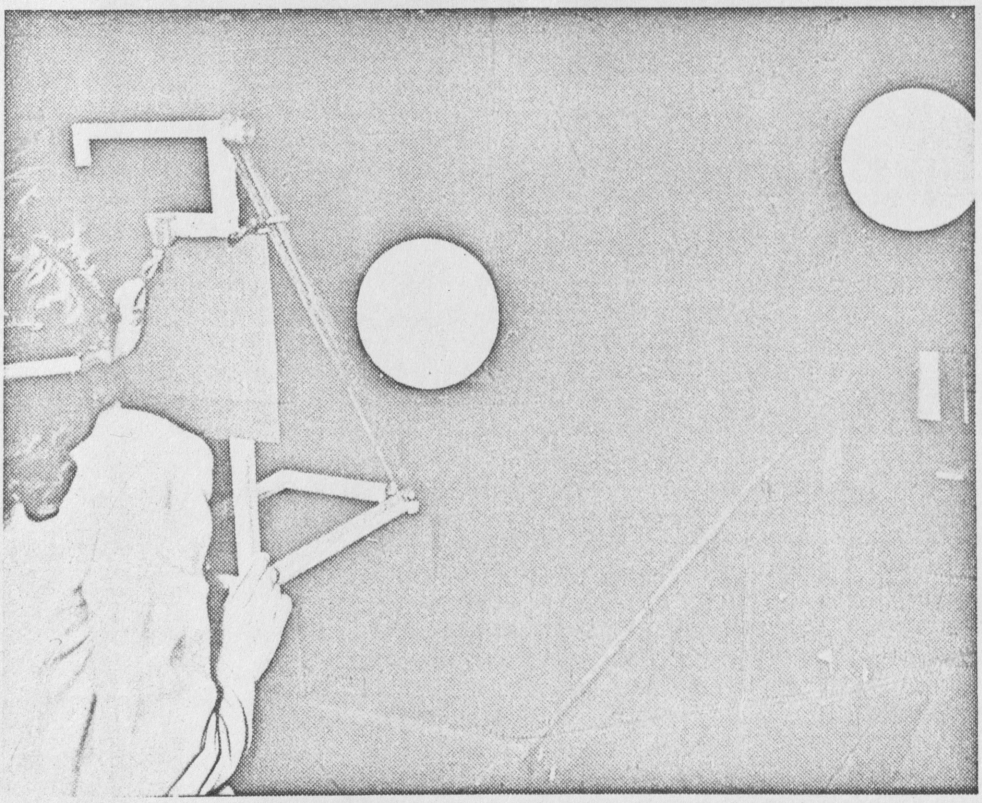

FIGURE 4. SIZE CONSTANCY (SENSORY) SITUATION.

of an ascending and a descending trial.

Prior to actual testing, there was a demonstration period in which the writer assured himself that each subject understood the nature of the judgment. This demonstration period took the following form:

> Before we actually do this part of the experiment, I want to make sure it is clear to you just what kind of a judgment is called for. First of all, I would like to have you imagine that you are looking at a house which is a mile away. You will realize that at that distance it will look very, very small. If you put your thumb up in front of your eye (E. demonstrates), your thumb might 'cover' the house. That is, your thumb might look larger than the house, although you know perfectly well that the house is actually many times larger. That is what we mean by apparent size or seeming size. And that is the kind of judgment we are going to make here. We are not interested in how large the objects actually are, but in how large they appear or seem to be.

Following this, the experimenter instructed the subject to close one eye and to observe the smallest figure (29.7 cm.) as he brought it closer and closer to the subject's eye. When the subject reported that it seemed to grow larger as it was brought closer, he was asked to compare its apparent size at approximately six inches from his eye to that of the standard at 230 cm. When the subject reported with confidence that the nearer circle seemed larger, the reduction screen was placed on the table and he was given the instructions proper:

> Now I am going to present a series of figures, gradually increasing in size, here (E. points to black wooden stand). After I place each figure here, I want you to compare it with the one at the end of the table and tell me if the apparent size of the one I place here is larger or smaller than the

> one at the end of the table. If a figure looks exactly the same, you may say 'same.' You will look through the slit in the cardboard here (E. points). Take your time and rest your eye any time you wish. You may look back and forth between the two figures as many times as you need to in order to decide if the one I place here is larger, smaller, or the same in <u>apparent</u> size as the figure at the end of the table.

Following the ascending series, the subject was instructed as follows:

> Now we are going to do the same thing exactly, except that I will begin with the largest of the figures and gradually decrease the size of these circles. Tell me each time whether the figure I place here is larger, smaller, or the same in apparent size as the figure at the end of the table.

It should be noted that for a few subjects several of the figures appeared to be "the same" apparent size as the standard stimulus. When this occurred, the subject usually commented upon it in surprise. In each such case, he was encouraged to make his judgment for each figure separately, "since it sometimes happens that several look just the same." In these cases, the largest figure called "the same" in the ascending trial and the smallest in the descending trial were used in the scoring.

The score for this test was the average size of the comparison figure judged "the same." There were no instances in which subjects did not say "the same" for one of the figures.

<u>Shape Constancy (Sensory) Judgment</u>: The shape constancy technique was a modification of a situation described by Thurstone (69).

The standard stimulus, viewed through a five inch by 3/4 inch slit in the black cardboard, one foot above the table surface, was a square of white cardboard four inches on a side. This was presented flat on the table at a distance of seven feet (213.36 cm.) from the subject's eye. Twenty-two comparison figures drawn in India ink on a white cardboard field 28 by 34 inches were presented at right angles to the subject's line of vision at a distance of 119.25 cm. (Figure 5). The horizontal axis of each comparison figure was 5 3/4 inches (equal to that of the standard). Vertical axes varied from 5 3/4 inches to $\frac{1}{2}$ inch, in steps of $\frac{1}{4}$ inch (Table II). The comparison figure producing an equivalent retinal image at this distance would have a vertical axis of approximately $\frac{1}{2}$ inch. Instructions for this test were:

> I want you to look through this slit in the cardboard keeping one eye closed at all times. You see that this figure is a square (E. picks up standard and shows to subject at a distance of about three feet from the subject's eyes). If I turn the figure this way (E. rotates figure 45 degrees clockwise), it looks like a diamond. Now you will notice (E. rotates the top of the figure away from the subject slowly) that if I rotate this figure it will seem to change its shape. For example, if I hold it this way (parallel to the subject's line of vision) it may even look like a straight line. (E. varies position of the figure until the subject indicates that he understands these instructions.) Now I will lay the figure on the table, here.
>
> I want you to look at it carefully. After you feel that you see clearly what its apparent shape is in this position, I want you to look at this board (comparison figures) and tell me which figure on the board is most like the apparent shape of the figure you see in front of you. Take your time. You may look back and forth as many times as you wish, but always keep the same eye closed. When you have selected the figure on the board which is most like the apparent shape of the figure in front of you, please point to it.

TABLE II

COMPARISON FIGURES FOR SHAPE CONSTANCY (SENSORY) JUDGMENTS

Figure Number	Vertical/Horizontal Axis in Inches	Ratio
1	5 3/4 / 5 3/4	1.00
2	5 1/2	.96
3	5 1/4	.91
4	5	.87
5	4 3/4	.83
6	4 1/2	.78
7	4 1/4	.74
8	4	.70
9	3 3/4	.65
10	3 1/2	.61
11	3 1/4	.57
12	3	.52
13	2 3/4	.48
14	2 1/2	.43
15	2 1/4	.39
16	2	.35
17	1 3/4	.30
18	1 1/2	.26
19	1 1/4	.22
20	1	.17
21	3/4	.13
22	1/2	.09

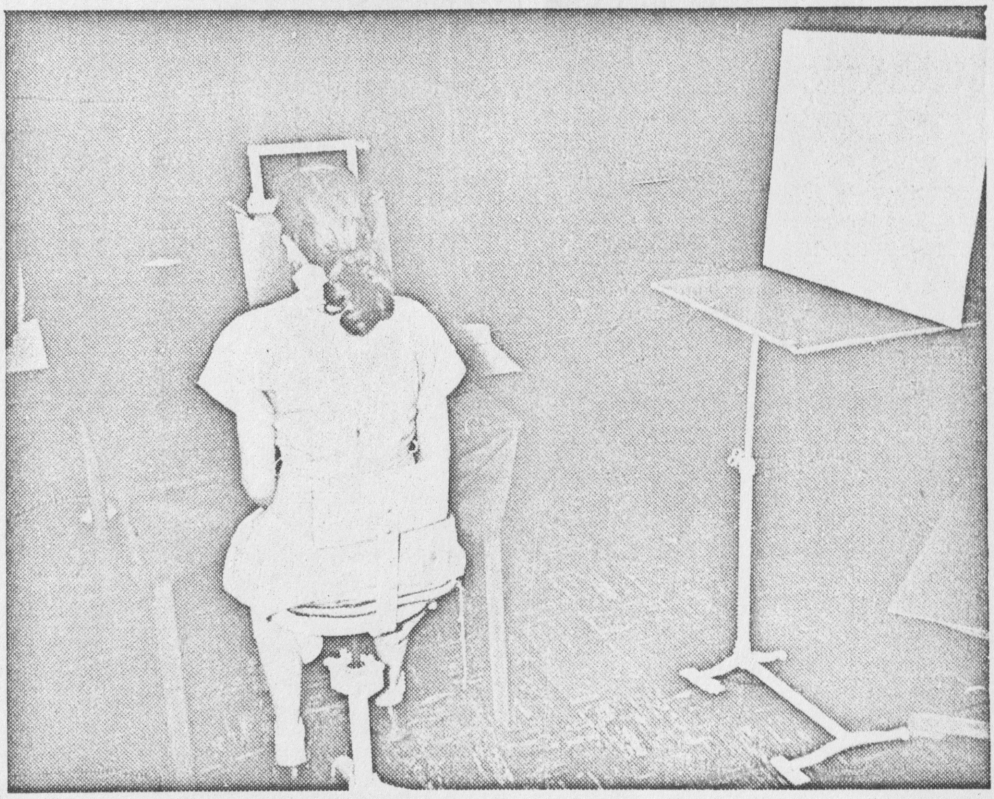

FIGURE 5. SHAPE CONSTANCY (SENSORY) SITUATION.

One judgment was made. The score was the ratio of the vertical to the horizontal axis in the figure chosen (Table II).

Brightness Judgments: Apparatus for this test consisted of two identical light boxes (Figure 6), each containing a 100-watt bulb and a polaroid lens attachment which could be adjusted by the experimenter through an aperture at the back of the box. Each light patch was a square one inch on a side. Judgments were made with the boxes in three positions: adjacent (distance between the centers of the patches of light, 21 inches); 90 degrees, and 180 degrees apart on an imaginary circle five feet in radius. Judgments were made in a dark room. The light patch on the right was the standard in each of the three judgments (one for each position). It was set at 110 footlamberts in each case, although the experimenter appeared to re-set it each time and the subject was not told whether the standard was changed or not. The left-hand patch was variable from 180 footlamberts above the brightness of the standard to 90 footlamberts below it. In each position, the experimenter gradually decreased the brightness of the comparison stimulus until the subject reported the two patches "exactly the same" in brightness. Instructions for this test were:

> This next situation calls for a brightness judgment. It has nothing to do with the size, shape, color, etc., of the two lights. This light on your right is the standard. I will set it each time. After that it will not change. You will see that I can change the brightness of the light on your left from very bright to very dim (E. demonstrates very slowly). Do you have any questions about this? (If there were none, E. proceded with the remainder of the instructions.) Now I am going to begin with the light on your left at very bright. I will gradually decrease its brightness.

FIGURE 6. BRIGHTNESS SITUATION.

I want you to tell me when the two lights are exactly the same in brightness. Take your time, so as to make your best possible judgment. If you wish to stop to check or to rest your eyes at any point, just tell me. If you overshoot the mark, feel free to direct me to change the brightness of this light until it seems to you exactly the same as that of the standard.

After the first judgment the subject was asked to look away or to close his eyes before checking it. All subjects took advantage of this suggestion to rest their eyes and to make more careful decisions. When the judgment in the first position was completed, the writer moved the boxes 90 degrees apart and "re-set" the standard. Instructions then were:

This time we are going to make exactly the same kind of judgment, except that the lights will be farther apart. Direct me as you did before, until you are as sure as you can be that the two lights are exactly the same in brightness.

Following this judgment, the writer placed the boxes in the 180 degree position. Instructions were:

We are going to make one more judgment of exactly the same kind. This time the boxes will be directly opposite each other. Direct me as before, until you can say that the lights are exactly the same in brightness.

The score for this test was the average error (footlamberts) for the three judgments.

CHAPTER III

RESULTS

Qualitative Observations

It was the writer's impression that there were several "routes" by which different subjects could attain the same number of groups in the object sorting test. Some of the subjects with many groups seemed to be doubt-ridden and obsessive in their approach to the task. They tended to sort and re-sort. It seemed that some could not reach a point at which they were thoroughly satisfied with their groupings. In fact, it was the writer's observation, clouded perhaps by the fact that this was one of his speculative expectations, that as a class the subjects with many groups were somewhat more intent, determined, and less comfortable in the test situations than those with few groups. Not all the subjects with many groups displayed doubtfulness and indecision, however. Some organized the objects in this way rapidly and spontaneously, as if for them there were no other possibility.

Among the subjects who verbalized aloud their thoughts while sorting, differences in sensitivity to subtle differences in the objects appeared to vary widely. This was true both among the subjects with few groups and among those with many. Thus, some subjects seemed to have many groups partly because they were unable to discern similarities. Others put the emphasis directly and squarely upon subtle differences. And some of those with very few groups offered a running

stream of comments indicating a notable sensitivity to differences and excellent vocabularies for capturing, say, slight variations in color or material. It was the writer's feeling throughout that in spite of these differences in the "routes" by which either few or many groups could be achieved, one crucial factor separated the two parts of the population: the subjects with many groups seemed impelled to act upon their awareness of differences, however vaguely they could conceptualize or verbalize this awareness. The subjects with fewer groups seemed to adopt a more "easy going" approach to their categorizations, whether or not they gave evidence of being highly aware of differences.

Perhaps a more detailed account of observations on two subjects--one with four groups and one with 30--will make more explicit the kinds of approaches that could characterize subjects in this study, although neither is thoroughly representative of the other subjects in his particular portion of the distribution.

Subject 2 (Four Groups): This subject is a 23-year-old housewife. She was graduated from college in 1950, with majors in history and languages. She is believed, on the basis of college entrance tests which were available, to be of superior intelligence. The first observation that can be made about her is that she seemed to enjoy thoroughly every aspect of the experimental procedure. The many questions she asked about the experiment seemed to spring from genuine interest, rather than, say, a fear that she was not doing well enough.

In spite of the fact that the object sorting test elicited a majority of "concrete" or "functional" categorizations (cf. 61) from many subjects, her four groupings were on a high order of abstraction. She made many comments about minor differences in color, shape, material, etc., during her sorting. She decided rather easily, however, to arrange all the objects according to their shapes: predominantly rectangular, elongated, circular, square. She worked hard at making accurate judgments in the other tests, but did so in a relaxed way which made her seem perfectly comfortable during the entire procedure. It can be observed from her quantitative data (Table IV) that she quite consistently followed the hypotheses for subjects with few groups.

Subject 50 (30 Groups): This is an 18-year-old university sophomore majoring in the social sciences. During the pre-experimental period, in which the writer attempted to put the subjects at ease and to get better acquainted with them, he seemed somewhat uneasy and appeared to be eager to get on with the tasks. He gave the impression of being a rather anxious, hard-driving person who "warms up" to strangers rather slowly. Although he gave indications of enjoying the tests themselves, he at no time appeared to be really relaxed. In the preliminary instructions for the object sorting test, he seemed to find it hard to believe that there was "no answer" to the test. Several of his questions during the test itself seemed to imply that he would be more comfortable if the situation were structured in terms

of objectively correct responses which he could strive for. In the other tasks, too, he seemed to be trying very hard to be exact. He deliberated longer than any other subject in the brightness situations. He seemed unwilling to admit that he could not do better, in spite of the fact that his judgments were quite accurate ones.

Despite an apparent insensitivity to subtle differences in the objects, he seemed to feel compelled to divide the items into many groups. In fact, at the end of the test, he was forced to conclude somewhat reluctantly that 15 of the objects would have to remain in "groups" by themselves. Since this was an unusual occurrence, the writer inquired with more than usual care into the reasons for his separating so many of the objects. During the inquiry it became apparent that, although he was not so subtly aware of differences as, for example, Subject 2, noticeable tension was aroused in him by the suggestion that some of the separated objects could belong together for this or that reason.

In spite of the relatively great psychological distance which this subject seemed to want to maintain between himself and the experimenter, he was polite, behaved appropriately, and was friendly during the entire experiment, if rather "cool" when compared with some of the other subjects. Following the experiment he asked several intelligent and pertinent questions about the purpose of the study.

Quantitative Findings

The actual scores for all subjects on the five tests appear in Table III. Table IV contains the T-Score values, arrived at by the formula $T = 50 + \frac{(X - M)}{\sigma}$. In all the statistical analyses subjects were arranged according to the number of groups they produced in the object sorting test. Thus, Subject 1 had three groups; Subject 50, 30 groups. T-Scaling was required to make scores on the five tests directly comparable. In the process of T-Scaling the data, the distribution of scores for each test was arranged in the direction implied by the hypothesis. This was necessary since subjects with the fewest groups in the object sorting test were expected to have the largest values on the other four tests.

Chi-square tests were done for the five tests with subjects divided into two groups according to: 1) age, 2) sex, and 3) student versus non-student status. None of these values approached significance.

The double classification analysis of variance (Table V) and the pattern analysis (Table VI) were done with the T-Score values. Table VII contains the means, differences between means, and t-test values (actual scores) when the subjects are divided (25 and 25) on the basis of the number of groups they produced in the object sorting test.

The table of actual scores for the five tests indicates a very large range in number of groups. It is noteworthy, also, that the spread

TABLE III

ACTUAL SCORES ON ALL TESTS FOR 50 SUBJECTS

Subject	Number of Groups	Size Constancy (Object). Mean Error (cm.).	Size Constancy (Sensory). Mean Diameter, Comparison Figure (cm.).	Shape Constancy (Sensory). Vertical/Horizontal Axis.	Brightness. Mean Error (Foot-lamberts).
1	3	2.63	37.95	.22	27.33
2	4	1.50	39.7	.57	45.00
3	4	1.75	30.05	.22	6.16
4	6	3.25	38.95	.39	10.83
5	7	2.25	39.7	.43	20.00
6	8	2.25	36.95	.30	29.47
7	8	1.75	36.95	.26	25.07
8	8	2.38	37.2	.39	20.00
9	8	3.75	34.2	.22	40.00
10	9	.75	38.45	.48	40.40
11	9	2.25	37.7	.43	35.07
12	9	.50	38.2	.30	37.60
13	10	3.00	32.5	.17	24.00
14	10	2.00	35.7	.22	15.67
15	10	2.50	35.95	.17	34.17
16	11	1.00	39.7	.30	4.13
17	11	.75	34.5	.39	30.33
18	12	4.25	35.7	.17	24.93
19	13	3.25	34.2	.26	18.63
20	13	.50	34.7	.39	37.00
21	14	2.75	37.45	.48	30.00
22	14	2.25	33.75	.57	17.40
23	14	1.00	36.45	.39	43.67
24	14	1.00	34.95	.57	32.00
25	14	1.75	35.2	.39	26.73
26	15	2.75	30.55	.26	16.00
27	15	1.00	34.7	.43	16.00
28	15	.75	33.7	.30	19.67
29	15	1.00	30.8	.35	48.33
30	15	2.25	32.25	.43	26.67
31	16	1.25	28.8	.17	10.67
32	16	1.00	33.75	.30	15.07
33	16	1.25	30.05	.26	35.67
34	17	1.25	29.3	.30	14.87
35	17	2.00	28.8	.17	4.77
36	17	1.00	36.2	.43	13.00
37	17	.25	28.8	.09	22.33
38	18	1.75	29.55	.30	45.13
39	19	.25	30.05	.26	25.13
40	19	.75	32.7	.43	16.60
41	19	1.25	33.0	.17	3.33
42	19	1.50	32.5	.39	10.53
43	19	1.25	34.7	.17	13.60
44	20	1.75	30.3	.26	17.67
45	20	1.50	36.45	.39	13.20
46	21	1.50	29.3	.26	20.00
47	23	.50	28.8	.22	10.40
48	23	1.50	29.55	.22	13.20
49	25	3.00	33.25	.22	25.47
50	30	1.75	28.8	.26	5.00

TABLE IV

T-SCORE VALUES ON ALL TESTS FOR 50 SUBJECTS

$$T = 50 \pm \frac{(X-M)}{\sigma}$$

Subject	Number of Groups	Size Constancy (Object). Mean Error.	Size Constancy (Sensory). Mean Diameter Comparison Figure.	Shape Constancy (Sensory). Vertical/Horizontal Axis.	Brightness. Mean Error.
1	30.1	39.8	37.9	57.8	46.1
2	31.8	52.2	32.7	27.4	31.0
3	31.8	49.5	61.3	57.8	64.2
4	35.4	33.0	35.0	43.1	60.2
5	37.2	44.0	32.7	39.6	52.4
6	39.0	44.0	40.9	50.9	44.3
7	39.0	49.5	40.9	54.3	48.0
8	39.0	42.5	40.1	43.1	52.4
9	39.0	27.5	49.0	57.8	35.3
10	40.7	60.4	36.4	35.2	34.9
11	40.7	44.0	38.7	39.6	39.5
12	40.7	63.2	37.2	50.9	37.3
13	42.5	35.7	54.1	62.1	48.9
14	42.5	46.7	44.6	57.8	56.1
15	42.5	41.2	43.8	62.1	40.3
16	44.3	57.7	32.7	50.9	65.9
17	44.3	60.4	48.1	43.1	43.5
18	46.1	22.0	44.6	62.1	48.1
19	47.9	33.0	49.0	54.3	53.5
20	47.9	63.2	47.5	43.1	37.8
21	49.6	38.5	39.4	35.2	43.8
22	49.6	44.0	50.4	27.4	54.6
23	49.6	57.7	42.4	43.1	32.1
24	49.6	57.7	46.8	27.4	42.1
25	49.6	49.5	46.1	43.1	46.6
26	51.4	38.5	59.8	54.3	55.8
27	51.4	57.7	47.5	39.6	55.8
28	51.4	60.4	50.5	50.9	52.6
29	51.4	57.7	59.1	46.5	28.2
30	51.4	44.0	54.8	39.6	46.7
31	53.2	54.9	65.0	62.1	60.3
32	53.2	57.7	50.4	50.9	56.6
33	53.2	54.9	61.3	54.3	39.0
34	55.0	54.9	63.5	50.9	56.7
35	55.0	46.7	65.0	62.1	65.4
36	55.0	57.7	43.1	39.6	58.3
37	55.0	65.9	65.0	69.1	50.4
38	56.8	49.5	62.8	50.9	30.9
39	58.5	65.9	61.3	54.3	48.0
40	58.5	60.4	53.5	39.6	55.3
41	58.5	54.9	52.6	62.1	66.6
42	58.5	52.2	54.1	43.1	60.4
43	58.5	54.9	47.5	62.1	57.8
44	60.3	49.5	60.6	54.3	54.3
45	60.3	52.2	42.4	43.1	58.2
46	62.1	52.2	63.5	54.3	52.4
47	65.7	63.2	65.0	57.8	60.6
48	65.7	52.2	62.8	57.8	58.2
49	69.2	35.7	51.8	57.8	47.7
50	78.1	49.5	65.0	54.3	65.2

TABLE V

VARIANCE TABLE FOR DATA ON FIVE TESTS

Source	Sum of Squares	df	Variance Estimate	F	P
Subjects	10,317.0280	49	210.5516	Subjects/ Residual =	
Tests	5.8724	4	1.4681	2.8111	.001
Residual	14,680.2756	196	74.8994		
TOTAL	25,003.1760	249			

TABLE VI

PATTERN ANALYSIS FOR DATA ON FOUR TESTS

VARIANCE TABLE

Source	Sum of Squares	df	Variance Estimate	F	P
Variables	5.78215	3	1.92738	Groups/Individuals = 44.04047	.001
Groups	3755.84445	1	3755.84445		
Individuals	4093.51960	48	85.28166		
V by G Interaction	538.62375	3	179.54125		
Residual	11,614.07160	144	80.65328		
TOTAL	20,007.84155	199			

TABLE VII

SIGNIFICANCE OF DIFFERENCES BETWEEN 25 SUBJECTS WITH FEWEST GROUPS AND 25 SUBJECTS WITH MOST GROUPS IN THE OBJECT SORTING TEST

Test	Mean of Subjects with Fewest Groups (N = 25)	Mean of Subjects with Most Groups (N = 25)	Difference	t	P
Size Constancy (Object). Mean Error (cm.).	2.040	1.360	.680	2.786	.01
Size Constancy (Sensory). Mean Diameter of Comparison Figure (cm.).	36.27	31.47	4.80	7.001	.001
Shape Constancy (Sensory). Vertical/Horizontal Axis of Comparison Figure.	.347	.282	.065	2.038	.02
Brightness. Mean Error (Footlamberts).	27.02	18.45	8.57	2.7120	.01

of judgments in the size constancy (sensory) situation range from choices of a comparison figure equivalent in actual size to the standard (39.7 cm.) to a comparison figure approximately equivalent in retinal image to the standard (29.7 cm.).

The analysis of variance table demonstrates quite conclusively that in general the subjects tend to be consistent with themselves in the various tests, in accordance with the hypothesis. In spite of the fact that some subjects are more consistent than others in the five tests, the general trend is towards preservation by individual subjects of unique modes of response which differentiate them from each other. Closer inspection of the data indicates that many subjects deviate on one or more tests from the general arrangement of scores hypothesized. This appears to be true both for those with few and those with many groups.

It is obvious that in the process of T-Scaling, which equates the means for the five tests, the possibility of investigating the variance attributable to tests was necessarily sacrificed.

As a further test of these findings, a pattern analysis was done for the two groups of subjects according to a method suggested by Block, Levine, and McNemar (8). One way of understanding the pattern analysis is to say that it tests the degree of interaction between the means of the two groups of subjects on four tests. The object sorting test results were excluded, since the subjects were arranged according to this "criterion." The F value which results

when the Groups variance is tested by the Individuals variance indicates that the overall means of four tests for the two groups of subjects are very significantly different.

The table of t-test values brings out quite sharply the fact that when subjects are divided into two groups on the basis of their performance in the object sorting test their mean scores are significantly different for each of the other tests.

Inasmuch as the brightness judgments were included as an extension of the original hypothesizing about performances in constancy situations, Figure 7 is included to demonstrate graphically the differences between the two groups of subjects. The mean error values for the 25 subjects with fewest and the 25 with most groups in the object sorting test were: 1) adjacent: 25.45 and 17.07; 2) 90 degrees: 30.96 and 19.13; 3) 180 degrees: 24.67 and 19.27; 4) grand means: 27.02 and 18.45. The t-test values were 2.1323, 2.4094, 1.3953, and 2.7120, respectively. All except that for the 180 degrees position are significant at better than the .02 confidence level (one-tailed test). The one non-significant difference is in the direction hypothesized.

It is difficult to understand the drop in average error when the light boxes are 180 degrees apart. It was originally hypothesized that this would be the most difficult of the three positions and that the two groups of subjects would diverge most widely on this judgment. It is perhaps possible that subjects were more challenged by this

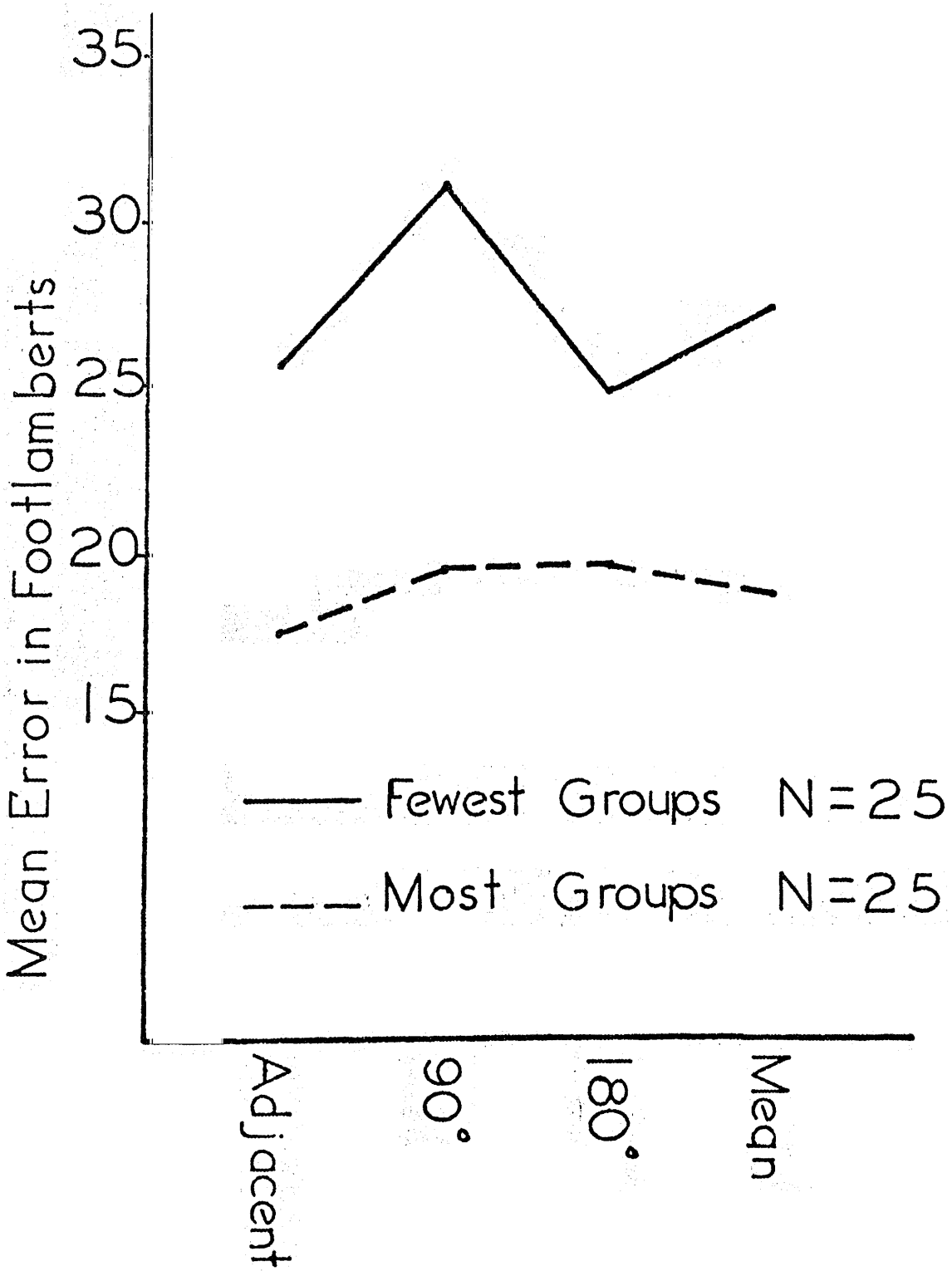

FIGURE 7. GROUP MEANS ON BRIGHTNESS JUDGMENTS.

judgment and exerted greater effort in making it. Qualitative observations offer little to support or deny this possibility. Obviously, the difference in the degree of conscious conceptual activity involved in the object sorting test and the brightness judgments is great. And, whereas the former task involves a kind of equivalence-range judgment closely akin to those of everyday experience, none of the subjects reported having done a laboratory brightness judgment previously.

To summarize the quantitative results, it can be said that results of the analysis of variance and the pattern analysis suggest rather strongly that--in spite of the obvious differences between the various tasks and their demands upon the subject, and in spite of the many other factors which must be involved in the judgments, and which cannot be investigated here--common adaptive modes are being tapped in the five measures. The t-tests are significant for all four tests when the subjects are divided on the basis of number of groups produced in the object sorting test.

It would seem possible from the highly significant nature of nearly all the results that this might be an unusually fortunate sample of subjects. This is a question which cannot be answered directly. It can be said that the range of performances in the object sorting test spans literally "worlds of difference" in approaches to categorizing.

It can also be said that, in spite of the somewhat limited age and educational ranges of the subjects in this population, their scores on the size constancy (sensory) judgments often reached both upper and lower "limits."

Further, only two subjects were rejected from the present population. One was suspected of having organic brain damage, on the basis of a unique performance in the object scoring test. This impression was later confirmed by clinical and neurological examinations. The other subject rejected was the only person in the series who was obviously unwilling to cooperate fully in making the judgments.

CHAPTER IV

DISCUSSION

The results of this study support the hypothesis that persons are characterized by consistent differences in what they will accept as similar or identical in a variety of adaptive tasks. It is notable that the hypothesized differences appear in spite of the fact that the subjects were drawn from a relatively homogeneous level of intellectual capacity. Subjects who were working at similar jobs at comparable levels of efficiency (e.g., the adjunctive therapy workers) varied widely in their positions on the scales. Differences in age (within our 18- to 30-year range), sex, and student versus non-student status seemed to contribute negligibly to the results.

The experience with the categorizing task involving a series of figures varying from triangular to circular, which was mentioned in the discussion of experimental procedures, seems to offer important indications of the conditions under which evidences of perceptual styles can be elicited. It would appear that when a situation is highly "structured" for the subject in terms of the stereotypic notions it elicits, one cannot expect to find preferences expressed in the same manner as in a task which demands that the subject organize the stimuli in his own way. The relatively "meaningless" nature of the triangular-circular continuum, which was viewed by the subjects to have but one dimension of variability, limits the expression of such preferences. The object sorting test, in which

a multitude of similarity dimensions can be utilized to organize the items, produces a much wider range of variation between the subjects, and this variation can be shown to have generality in the other tasks.

It is especially interesting that the individual differences also appear in predictable fashion in the brightness judgments. This task involves a less complex kind of conceptualizing than does the object sorting test. In one sense, these judgments supply a rough estimate of the person's differential limen for brightness under these conditions. The results suggest the need for further research in the area of DL differences, including other tasks and other modalities than those investigated here.

The fact that these characteristic modes of perceptual organization can be demonstrated in such experiences as those involved in constancy and brightness judgments raises some interesting theoretical points. First of all, it seems obvious that the simpler decisions are not meaningful to the subjects in the same way as decisions about categorizing objects familiar to them from their everyday experience. The nature of the continua is so varied as to suggest that certain central aspects of the person's orientation towards his world (aspects which we can at the moment only speculate upon) find expression both in the quality of his conceptualizing and in his performance on tasks requiring more immediate and less conceptualized responses.

Qualitative observations of performances in the object sorting test suggest that subjects can "solve the problem" by placing the items in very few groups in spite of the fact that they may be cognizant of subtle differences. It would seem that the subjects with few groups choose not to act upon their awareness of difference. It is thus not a matter of unawareness of, but of "tolerating" differences by virtue of a rather relaxed attitude towards them. The subjects with broad equivalence ranges (few groups) seem to be governed by an "economy motif," so to speak, whereas the subjects with many groups are characterized by a concern for non-overlapping boundaries.

Performances falling at the ends of the distributions would seem to reflect basically very different central orientations towards the external world. It may be appropriate to offer some speculations about these results.

It might be hypothesized that difference-identity continua as such have very different meanings for persons falling at the extremes of the distributions. It seems possible that such continua, as aspects of the perceptual field, have much greater importance for some of the subjects with narrow equivalence ranges. This is supported by the observation that a number of these persons seemed impelled to act upon their awareness of differences, and that this impulsion took the form of further subdivision of potentially broad categories. Other observations point to the possibility that these subjects somehow attach a greater importance to distinguishing

between the "objectively" accurate and the more apparent qualities of stimuli (whichever is demanded at the moment). It would appear that extreme subjects thus differ markedly in their preferred ways of knowing the world about them. It seems especially important for some of the subjects with narrow equivalence ranges to know the world in terms of its reducible, classifiable features.

If presented with some of Ames' demonstrations (4, 5), these subjects might become rather tense when confronted with situations which defy their carefully-collected "objective" knowledge of the outer world. It might be assumed that subjects given to broad equivalence ranges are much less disturbed by dissimilarity and incongruity, and that they would accept such perceptual anomalies with greater equanimity. Further, it may be that for these latter persons knowledge of the exact nature of the outer world is relatively less important as a mode of reality-testing because they can utilize their feelings more effectively in the process of reality-testing.

Thus, the following attributes might be hypothesized for some of the persons with narrow equivalence ranges, in relation to those with broad ranges: 1) a more intense need to know the real qualities of the outer world; 2) a greater concern with control of affect; 3) tendencies in task situations to shy away from a close personal relationship to the experimenter and to seek out and focus upon verifiable criteria in the tasks (the sort of

relationship inferred, for example, from the behavior of Subject 50).

Affect-control may not be as pressing a problem for the persons with broad equivalence ranges, who seem to adopt a more relaxed approach in tune with "adaptive economy," rather than objective verity. This is not to assume that the persons with narrow equivalence ranges would express less affectively-laden material in the testing situations. Their expressions might be of an order which would reveal their dissatisfaction with "open" situations and their tendency to search for the objectively verifiable by virtue of focussing upon the task and increasing their psychological distance from the experimenter. Their affect-laden expressions thus might be more negative, more critical, and less conducive to a warm relationship than in the case of the persons with broad equivalence ranges.

If such hypotheses could be verified, some of the persons with narrow equivalence ranges would appear to be "externalizers," persons who lose something of their ability to examine their feelings by virtue of their intense focus upon aspects of the perceptual field which are outside their own physical boundaries. It might be expected that in a relatively unstructured situation, such as that represented by the Rorschach test, they would be highly critical of their responses and/or the blots; would avoid "playing" with the stimulus materials by expressing phantasies which would

elaborate upon the percepts themselves; and would give many indications (however subtle) of dissatisfaction with the objective verifiability of their responses. The elaborations they would make might be expected to reflect different purposes from those of persons with broad equivalence ranges: the striving for verifiability; the need to qualify responses to this kind of material; and the attempt to absolve themselves of responsibility for the "correctness" of these responses. In these respects they might appear to have much in common with persons shown to be relatively intolerant of instability in perceptual fields (45, 22).

In his observations of subjects at the other extreme, the writer was more frequently impressed with feeling-oriented relationships to the experimenter and to the tasks. These subjects, too, relate themselves to the outer world in terms of its objective characteristics, but at the same time they seem to have less need for control of the feelings aroused in them by the situation.

These are some of the possibilities which arise from an examination of both the quantitative and the qualitative results. It is obvious that these questions can be answered only by further investigations. Inasmuch as the writer feels that one of the primary values of the present study is the opportunity it affords for exploring the meaning for the person of particular equivalence-range preferences, some of the proposed studies are listed below. Work on the first three is in progress and involves the 50 subjects reported upon here.

Extensions of the Present Experiment

Reproduction of Tachistoscopically-Presented Figures: The inclusion of this procedure arises from an attempt to think through the meaning of differences in categorizing behavior in terms of trace theory as developed by Koffka (48), Köhler (49), and others. It has been demonstrated that attitudes or sets can have important effects in the communication between process and trace in any momentary activity and, probably, between traces themselves. The present experimental findings seem to point to a continuum of relatively permanent sets or set-predispositions pertaining to the importance (demand value) of differences in the psychological environment. This is not to say that what is meant here by an attitude or predisposition is identical with what Koffka had in mind. Trace theory, however, may add to the understanding of these more general and permanent phenomena.

At one end of the continuum are persons whose cognitive efforts seem to revolve, at least in part, around the importance of differences; at the other are those to whom differences may be apparent but seem less important. It might be assumed that persons with narrow equivalence ranges as defined in these tasks are characterized by traces which are relatively more isolated, tend to maintain their unique identity, and are thus more stable. One might expect relatively less communication between traces or between process and traces in any task of momentary judgment and also a

set aimed at isolating relatively small portions of the perceptual field into meaningful units (an effect of previous traces on the momentary process).

It would appear that not only is it true, as Lewin (50, 51) and others have demonstrated, that sets can influence these kinds of communication, but also that there are individual differences in long-term predispositions. These predispositions may have unique effects for various individuals when more immediate sets are brought about through specific instructions. In the size constancy (sensory) judgments, it was hypothesized that the subject with many groups in the object sorting test--possibly by virtue of having smaller, more stable, and more isolated traces in his trace-hierarchies--would perceive the continuum of sensory-object variation more clearly as two separate perceptual organizations. In the case of the tachistoscopically-presented figures, he might be expected to allow less variation within the category "identical to the figure on the screen," and thus be "hyperalert" to asymmetry and lack of closure.

In terms of shrinkage, one could speculate that the traces of persons with narrow equivalence ranges are characterized by relatively firm boundaries. If so, they should be less easily disturbed by communication from other traces. One might expect consolidation of traces over time, which would have the effect of preserving as exactly as possible the representatives of the outer

world. A factor in this assumed consolidation and boundary firmness might be that of relatively greater shrinkage.

A preliminary method for testing these hypotheses is presented below. Trials of this procedure with the 50 subjects of the present experiment make it obvious, although the data have not been completely analyzed, that certain revisions are necessary in order to test the hypotheses. For one thing, since the reproductions of different subjects are not directly comparable, some method of roughly equating their responses must be used. A possible way to do this is to ask the subject for a delayed reproduction (say, after an hour) as well as an immediate reproduction. The relative increment or decrement in the size of the reproduction might be used as a measure of shrinkage.

Each of four geometrical figures was flashed on a white screen for 1/10 second by means of a Keystone tachistoscope placed 20 feet from the screen in a dark room. The subject, who sat in a chair 10 feet from the screen, was provided with a pencil and pad of paper. A masked light on the desk chair provided enough illumination for drawing. The figures averaged about 20 inches in height as they appeared on the screen. After the subject had grown accustomed to the dark, these instructions were given:

> I am going to flash some figures on the screen in front of you, there (E. flashes a light square on the screen at the place where the figures will appear). The figures will appear for just that long, so pay careful attention. After each figure is flashed, I want you to draw it exactly

as it looked to you, on the paper in front of you. Take all the time you need to draw each figure. I will flash each figure immediately after I say 'Ready.' Any questions? (If there were questions, the instructions were reviewed following their discussion. E. then presented the first figure.)

Several measures are contemplated for this test: 1) shrinkage values, as suggested above; 2) measures of preservation of asymmetry; 3) a measure of closure for one "open" figure (a cross). Each of these measures would be a relative increment or decrement, with the subject's delayed reproduction serving as the baseline for measurement. The narrow equivalence range subjects would be expected to show relatively greater shrinkage, greater preservation of asymmetry, and greater resistance to closure.

Memory Task: The two stories from the Babcock Test (6) were read twice to the subjects of the present experiment. At the end of one hour they were asked to write the stories as exactly as possible. These stories were selected because of their brevity and because of the marked similarity of their structures. In keeping with the suggestions above concerning trace theory, one might expect subjects with narrow equivalence ranges to preserve the stories relatively well in their original form, or to "shrink" them to simpler forms. It might be, also, that both broad and narrow equivalence range persons would be characterized by elaborations upon the original stories, but that qualitative differences in the "purpose" of these elaborations could be discerned. For example, elements of the stories which seemed to conflict might be simplified

by narrow equivalence range persons. More additive elaborations might be expected from the broad equivalence range persons, in keeping with the hypotheses about their performance in the Rorschach test.

The F-Scale: Speculations about the possibility of "externalizing" tendencies in the narrow equivalence range persons (an elaboration of this appears in the first part of the Discussion section) led to the inclusion of this scale. The tentative hypothesis was that these subjects would tend to be more "authoritarian." Although it is our present impression that the 50 original subjects are remarkably similar in respect to such attitudes, an item analysis of this scale may offer some clues as to possible attitudinal differences between our two groups of subjects.

Problem-Solving Tasks: An interesting extension of the present findings would be the observation of subjects from the ends of the distributions of the present experiment in problem-solving tasks. It might be speculated, for example, that persons with narrow equivalence ranges are (as was assumed above) characterized by traces which tend to preserve their identity and which tend to resist communication and/or contaminatory infusions from other trace-hierarchies. If this were true, one might tentatively hypothesize that these subjects would shift more slowly from one kind of approach to a completely different kind of approach in such tasks. It might be that they would tend to "subdivide" their initial approach into

variations of it before moving on to a relatively fresh start.

DL Studies: In view of the findings relative to differences in the brightness judgments of the present experiment, one of the first steps forward may be to determine individual consistency in discrimination tasks representing other modalities and other stimulus configurations. Such studies would give further knowledge about the universality within the person of the preferred modes of organizing experience pointed to in the present study.

Clinical Explorations: Both the speculations about what kinds of persons would be likely to fall at the extremes of distributions in the present experiment and some of the qualitative observations during the testing itself point towards the possible existence of measurable differences in the affective responsiveness of the subjects to the world about them. The present best guess would seem to be that subjects with narrow equivalence ranges are prone to focus upon the "out there" for confirmation of their hypotheses about the nature of the external world. This corresponds to the observation that some of these subjects "had to know" whether they did well or poorly in terms of verifiable criteria. Observation of subjects with broader equivalence ranges suggested that they may be characterized by a more easy-going approach to their surroundings, one in which they are relatively free to use their feelings in understanding their experience. At least some of the subjects with broad equivalence ranges gave the impression

of greater warmth and freedom in the testing situations and of less intense preoccupation with the objective correctness of their responses. This is not to be construed as a difference in the effort involved in making judgments, but rather as a commentary upon the aspects of the experimental situations which seemed to attract the major portion of their attention.

The writer's tentative impression is that the persons with narrow equivalence ranges are probably less introspective, less likely to give free play to phantasy activity (as this might be represented in various projective tests), and less likely to focus upon those aspects of a testing situation which would reduce the psychological distance between themselves and the experimenter than are the persons with broad equivalence ranges.

It might be that a clinical interview by a skilled professional worker would allow rating of the subjects in terms of the ease with which they "warm up" to a new acquaintance. These and similar techniques should be especially important in adding knowledge of the meaning for the person of different modes of approach to categorizing tasks, whether or not the eventual results follow our present best guesses.

Relations to Other Studies of Perceptual Attitudes: From the point of view of theory construction and as an economical method of checking hypotheses about our subjects, it will be important to compare their performances in the present experiment with their

modes of approach to tasks developed in the same laboratory and from the same general matrix of thinking about perceptual phenomena and personality theory. It was noted in the size constancy (sensory) situation, for example, that several of the subjects with broad equivalence ranges seemed to experience from two to as many as four or five circles in the series of comparison figures as "apparently the same" as the standard. Although the present study was not designed to take full advantage of such observations, they suggest that some of the subjects with few groups may be similar in schematizing behavior to what has been called the "leveler" (32, 40, 41) on the basis of performance in tasks especially designed to elicit schematizing preferences. Other studies from this laboratory which may have interesting relations to our findings include explorations of individual differences in distractibility; in characteristic response to an experimentally-induced need; and, as was suggested above, in differences in respect to tolerance versus intolerance for instability (45, 22).

CHAPTER V

SUMMARY AND CONCLUSIONS

Fifty subjects between the ages of 18 and 30 were tested in five tasks—an object sorting test and a series of constancy and brightness judgments—in the expectation that their performances would reflect consistent individual differences in equivalence ranges. All the results of the experiment strongly supported the hypothesis that persons are characterized by unique equivalence-range preferences in a variety of adaptive tasks.

Both the quantitative and qualitative results suggested that certain central aspects of an individual's orientation towards the outer world (aspects which can, as yet, only be speculated upon) find expression in tasks demanding widely different degrees of conscious conceptualizing.

An attempt was made to utilize the qualitative observations of the subjects as aids in the formulation of hypotheses about the meaning for the person of a particular kind of equivalence-range preference. It was speculated, for example, that persons at the extremes of the distributions may relate themselves to the world about them in quite different ways in their preferred modes of reality-testing, in their ways of "knowing" the external world, and in their affective responsiveness to persons and things.

Inasmuch as the results raise a number of questions which

can be best answered by further investigations, a list of proposed extensions of the experiment was offered, with some of the writer's thinking about them.

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